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Water-Resources Investigations In Texas

Fiscal Year 1975

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

WATER-RESOURCES INVESTIGATIONS IN TEXAS FISCAL YEAR 1975

Austin, Texas

January 1975

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WATER-RESOURCES INVESTIGATIONS IN TEXAS

FISCAL YEAR 1975

INTRODUCTION

The water-resources investigations in Texas consist of the collection of basic records through the hydrologic-data network, interpretive studies, and research projects. The basic-data records and the results of investigations are published by the Geological Survey or by cooperating agencies. This report describes the water-resources projects and activities of the Geological Survey in Texas for the 1975 fiscal year (July 1, 1974, to June 30, 1975).

The Geological Survey's investigations of the water resources of Texas are under the general direction of I. D. Yost, District Chief. The Texas District office is in the Federal Building, 300 East Eight Street, Austin, Texas 78701.

Copies of unpublished records, copies of basic data prior to publication, and copies of other unpublished records may be obtained from the District office by request.

Information regarding provisional records of stream discharge prior to publication and other hydrologic data collected within their respective areas may be obtained from the sub-district offices in Austin, Fort Worth, Houston, San Angelo, San Antonio, and Wichita Falls. Requests for information should be addressed as follows:

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COLLECTION OF BASIC HYDROLOGIC DATA

A significant activity of the Texas District is the collection of basic hydrologic data. A continuing series of measurements and analyses are made of streamflow, reservoir contents, chemical quality of water, sediment in streams and reservoirs, water levels in wells, and land-surface subsidence.

Modern computer techniques are being successfully utilized to collect, compute, and disseminate basic water data. By the end of the 1975 fiscal year, the following installations will be in operation: Approximately 415 digital recorders at stream-gaging stations; 31 conductivity (digital) recorders; and 2 instruments for continuously and simultaneously monitoring and recording the water-quality characteristics of conductivity, water temperature, dissolved oxygen, and pH. The use of electronic data processing for storage and retrieval of water records will continue to be expanded.

Surface-Water Records

Continuous-Record Streamflow Stations

As of June 30, 1974, 551 stream-gaging, reservoir-content, and stage stations were in operation. During the 1975 fiscal year, 14 stream-gaging, 5 reservoir-content, and 1 stage stations will be established; and 3 stream-gaging, 1 reservoir-content, and 3 stage stations will be discontinued. At the end of the 1975 fiscal year, 564 continuous-record stations will be in operation.

Partial-Record Streamflow Stations

Low-flow partial-record stations.--As of June 30, 1974, 99 low-flow partial-record stations were in operation. During the 1975 fiscal year, 9 stations are scheduled to be established and 15 stations will be discontinued.

Crest-stage partial-record stations.--As of June 30, 1974, 194 crest-stage partial-record stations were in operation. Of these, 40 were operated in the urban-hydrology study areas in Dallas, Houston, and San Antonio. Eleven additional stations are scheduled to be established during the 1975 fiscal year. No stations will be discontinued.

Flood-hydrograph partial-record stations.--As of June 30, 1974, no flood-hydrograph partial-record station was in operation. Fifteen stations are scheduled to be established during the 1975 fiscal year.

Flood-profile partial-record stations.--As of June 30, 1974, eight flood-profile partial-record stations were in operation, all in the San Antonio urban study area. No additional stations are to be established or discontinued during the 1975 fiscal year.

Tide-level stations.--As of June 30, 1974, 37 tide-level stations were in operation. During the 1975 fiscal year, 11 additional stations will be established. No stations are scheduled to be discontinued.

Continuous Water-Quality Stations

As of June 30, 1974, 1 multiparameter water-quality monitor and 29 conductivity recorders were in operation. No additional conductivity recorders will be established during the 1975 fiscal year. The water-quality monitor is located on the Sabine River, and the conductivity recorders are located at stations in the Red, Neches, Brazos, Colorado, and Guadalupe River basins. One multiparameter water-quality monitor is scheduled for installation on the Trinity River near Crockett during the 1975 fiscal year.

Daily Water-Quality Stations

Daily chemical-quality stations.--As of June 30, 1974, 112 daily chemical-quality stations were in operation. Sufficient samples were collected at these stations to define the total daily chemical loads. During the 1975 fiscal year, eight new stations will be established.

Daily suspended-sediment stations.--As of June 30, 1974, six daily suspended-sediment stations were in operation. No additional stations are scheduled to be established.

Partial-Record Water-Quality Stations

Partial-record chemical-quality stations.--As of June 30, 1974, the partial-record chemical-quality network consisted of stations at 156 sites on streams and stations at 53 sites on reservoirs. During the 1975 fiscal year, no new stations will be added to the network.

Special periodic water-quality sampling sites.--Special periodic sampling will be done during the 1975 fiscal year at 152 stations. The analyses will include determinations of standard chemical-quality, BOD (biochemical oxygen demand), DO (dissolved oxygen), NO_3 (nitrate), PO_4 (phosphate), pH, pesticides in unfiltered water samples and bottom deposits, and minor elements.

Periodic suspended-sediment stations.--The periodic suspended-sediment station network was established in 1966, and as of June 30, 1975, 35 stations were in operation. No expansion of this network is scheduled for the 1975 fiscal year.

Lake and Reservoir Studies

The fiscal 1975 program provides for three water-quality surveys each of: Lake Meredith, Greenbelt Reservoir, Lake Arlington, Livingston Reservoir, Lake Conroe, Hubbard Creek Reservoir, Possum Kingdom Reservoir, Lake Granbury, Whitney Lake, Belton Lake, Canyon Lake, and Lake Corpus Christi; and two surveys of Sam Rayburn Reservoir and Town Lake (Austin). On-site determinations will be made of specific conductance, dissolved oxygen, temperature, and pH. Samples will be collected for laboratory analyses during each survey.

Summary of Scheduled Changes in Data Stations

Type of record: C--crest-stage partial-record; D--streamflow; G--stage only; H--flood-hydrograph partial-record; L--low-flow partial-record; R--reservoir content; Op--periodic organic water-quality; Qc--continuous-recording water-quality; Qp--periodic chemical-quality T--Tide level

New Stations to be Established

Name of station	Type of record	Cooperation with USGS	of station and remarks
07299500 Prairie Dog Town Fork Red River near Estelline, Tex.	LQp	Corps of Engineers	To determine the sources of chloride and chloride loads in this basin.
07299505 Prairie Dog Town Fork Red River below Mountain Creek near Estelline, Tex.	LQp	do	do
07299510 Prairie Dog Town Fork Red River above Jonah Creek near Estelline, Tex.	LQp	do	do
07299512 Jonah Creek at weir near Estelline, Tex.	DQc	do	do
07299514 Jonah Creek below weir near Estelline, Tex.	DQc	do	do
07299516 Jonah Creek at mouth near Estelline, Tex.	LQp	do	do
07299530 Salt Creek near Estelline, Tex.	DQc	do	do
07344482 Big Cypress Creek near Winnsboro, Tex.	D	Franklin Co. Water District through the Texas Water Development Board	To aid in the water management in the Cypress Creek basin.
07344484 Lake Cypress Springs near Newsom, Tex.	R	do	do
07298100 MacKenzie Reservoir near Silverton, Tex.	R	MacKenzie Water Authority through the Texas Water Development Board	To provide a record of reservoir contents and to furnish an inventory of water in basin storage
08022060 Martin Creek Reservoir near Tatum, Tex.	R	Texas Utilities Services Inc. through the Texas Water Development Board	To aid in the water management in the Sabine basin.
08022070 Martin Creek near Tatum, Tex.	D	do	do
08025307 Mill Creek near Burkeville, Tex.	D	Gulf States Utilities through the Sabine River Authority	To monitor the quality and quantity of water from this basin before, during, and after construction of a nuclear generating station.

New Stations to be Established--Continued

Name of station	Type of record	Cooperation with USGS	Purpose of station and remarks
08068400 Panther Branch near Conroe, Tex.	D	George Mitchell Associates through the Texas Water Development Board	To study the effects of urbanization.
08074780 Keegans Bayou at Keegan Road near Houston, Tex.	C	City of Houston	do
08077780 Highland Bayou near Texas City, Tex.	C	Corps of Engineers	To sample high tide in this estuary.
08082800 Millers Creek Reservoir near Bomarton, Tex.	R	North Central Texas Municipal Water Authority through the Texas Water Development Board	To provide a record of reservoir contents and to furnish an inventory of water in basin storage.
08105000 San Gabriel River at Georgetown, Tex.	QpOp	Corps of Engineers	To sample the quality of water from the reservoirs above station.
08112200 Brazos River near Wallis, Tex.	G	Houston Lighting and Power Co. through the Texas Water Development Board	To aid and assist in the operation of a cooling water reservoir that will be used as part of a nuclear generating station.
08154700 Bull Creek at Loop 360 near Austin, Tex.	H	City of Austin	To study the effects of urbanization.
08154750 West Bull Creek at Loop 360 near Austin, Tex.	H	do	do
08154760 Bull Creek at Lakewood Drive, Austin, Tex.	LQpOp	do	do
08155200 Barton Creek at State Hwy. 71 near Oak Hill, Tex.	H	do	do
08155300 Barton Creek at Loop 360, Austin, Tex.	H	do	do
08156650 Shoal Creek at Steck Avenue, Austin, Tex.	H	do	do
08156700 Shoal Creek at Northwest Park, Austin, Tex.	D	do	do
08156750 Shoal Creek at White Rock Dr., Austin, Tex.	H	do	do
08156800 Shoal Creek at 12th Street, Austin, Tex.	HQpOp	do	do

New Stations to be Established--Continued

Name of station	Type of record	Cooperation with USGS	Purpose of station and remarks
08158050 Boggy Creek near mouth, Austin, Tex.	LQpOp	City of Austin	To study the effects of urbanization.
08158100 Walnut Creek at Farm Road 1325 near Austin, Tex.	H	do	do
08158200 Walnut Creek at Dessau Road near Austin, Tex.	H	do	do
08158300 Walnut Creek Tributary at Springdale Road, Austin, Tex.	H	do	do
08158400 Little Walnut Creek at Lamar Blvd., Austin, Tex.	H	do	do
08158500 Little Walnut Creek at Manor Road, Austin, Tex.	H	do	do
08158640 Walnut Creek at Southern Pacific RR bridge, Austin, Tex.	HQpOp	do	do
08158700 Onion Creek near Driftwood, Tex.	LQpOp	do	do
08158930 Williamson Creek at Manchaca Road, Austin, Tex.	H	do	do
08158970 Williamson Creek at Jimmie Clay Road, Austin, Tex.	HQpOp	do	do
08164532 East Overflow Lavaca River near Lolita, Tex.	T	Texas Water Development Board	Records needed to define the hydrologic regimen of Lavaca Bay.
08164534 West Overflow Lavaca River near Vanderbilt, Tex.	T	do	do
08164540 Menefee Lake No. 1 near Vanderbilt, Tex.	T	do	do
08164545 Menefee Lake No. 2 near Vanderbilt, Tex.	T	do	do
08164550 Menefee Bayou near Vanderbilt, Tex.	T	do	do

New Stations to be Established--Continued

Name of station	Type of record	Cooperation with USGS	Purpose of station and remarks
08164555 Lavaca River near Vanderbilt, Tex.	T	Texas Water Development Board	Records needed to define the hydrologic regimen of Lavaca Bay.
08164560 Redfish Lake near Lolita, Tex.	T	do	do
08164565 Redfish Lake No. 2 near Lolita, Tex.	T	do	do
08164570 Swan Lake near Point Comfort, Tex.	T	do	do
08164575 Swan Lake No. 2 near Point Comfort, Tex.	T	do	do
08164580 Venado Lakes near Vanderbilt, Tex.	T	do	do
08169500 Guadalupe River at New Braunfels, Tex.	D	Corps of Engineers	Established as a flood-warning forecasting station.

Type of record: D--streamflow; L--low-flow partial-record; R--reservoir content; Qp--Periodic chemical-quality

Stations to be Discontinued

Name of station	Type of record	Cooperation with USGS	Reason for discontinuance
07227200 Tramperos Creek near Stead, N. Mex.	D	Operated by New Mexico District	Discontinued for lack of cooperative funds.
07343300 Cuthand Creek near Bogata, Tex.	D	Texas Water Development Board	Sufficient data have been collected to satisfy the project objectives.
08076900 Carpenters Bayou at Cloverleaf, Tex.	L	do	Station has been dropped from Galveston Bay project.
08077510 Clear Creek above Turkey Creek near Friendswood, Tex.	L	do	Do
08077620 Armand Bayou near Genoa, Tex.	L	do	Do
08083200 Lake Sweetwater near Sweetwater, Tex.	R	do	Insufficient cooperative funds are available for continuation of station.
08211500 Nueces River at Calallen, Tex.	Qp	do	Sufficient samples have been collected to satisfy the project objectives.
08363840 Rio Grande at Vinton Bridge near Anthony, Tex.	D	do	Sufficient data have been collected to satisfy the project objectives.

Ground-Water Records

A network of observation wells for observing fluctuations in ground-water levels, changes in chemical quality of ground water, and subsidence of the land surface is maintained in areas of large ground-water development. The periodic collection of ground-water data can be used in solving such specific problems as over-development and its relation to pumping costs, relationship of recharge to discharge of an aquifer, and the relationship of the quality of ground water to the development and use of the water in storage.

The observation-well network is confined to the areas of continuing ground-water studies in the Houston area, Galveston County and adjacent areas, San Antonio area and Balcones Fault Zone, El Paso area, and Orange County and adjacent areas. As of June 30, 1974, the Geological Survey was monitoring more than 1,200 wells. The types and numbers of observation wells programmed for the 1975 fiscal year by areas are given below:

Area	Water levels		Chemical quality	Subsidence
	Periodic	Continuous		
Houston area	500	6	90	7
Galveston County and adjacent areas	90	2	35	1
San Antonio area and Balcones Fault Zone	8	10	5	0
El Paso area	244	10	14	0
Orange County and adjacent areas	87	1	58	0

PROJECT STUDIES

Hydrologic Studies of Small Watersheds

The U.S. Soil Conservation Service (SCS) has an extensive program of constructing floodwater-retarding structures in small watersheds in Texas. These structures, which are designed to control floodflows and sediment movement, will have varying but important effects on the natural surface- and ground-water resources of river basins, especially where a large number are built. The need has grown for basic hydrologic data on these small watersheds to compare the hydrology under natural and developed conditions. It is, therefore, essential that the hydrologic studies determine the extent to which the floodwater-retarding structures affect the volume and mode of occurrence of runoff.

The specific objectives of these studies are:

(1) To determine the net effect of floodwater-retarding structures on the regimen of streamflow at downstream points.

(2) To determine the effectiveness of the structures as ground-water recharge facilities.

(3) To determine the effect of the structures on the sediment yield at downstream points.

(4) To develop relationships between maximum rates and volumes of runoff with rainfall in small natural watersheds.

(5) To develop a stream-system model for basins with floodwater-retarding structures.

(6) To determine the minimum instrumentation necessary for estimating the flood hydrographs below a system of structures, as needed for downstream water-management operations.

Hydrologic studies of SCS-developed areas in Texas, which were started in 1951, have been made by the Geological Survey in 12 small watersheds to provide the needed data for analyses. The U.S. Soil Conservation Service, Texas Water Development Board, San Antonio River Authority, city of Dallas, and the Tarrant County Water Control and Improvement District No. 1 cooperated with the Geological Survey in these studies. The 12 study areas were chosen on a statewide basis to sample watersheds having different rainfall, topography, geology, and soils. In five of the study areas, streamflow and rainfall records were collected prior to construction of the floodwater-retarding structures, thus affording the opportunity for analyses of the hydrologic conditions before and after construction.

The 12 study areas, which are in four major river basins, are North Creek, Elm Fork Trinity River, Little Elm Creek, Honey Creek, and Pin Oak Creek, all in the Trinity River basin; Green Creek, Cow Bayou, Little Pond-North Elm Creeks, in the Brazos River basin; Deep and Mukewater Creeks in the Colorado River basin; and Escondido and Calaveras Creeks in the San Antonio River basin.

The long-range plan for the small-watershed studies specified that the data-collection program in each study area be skeletonized when data were sufficient to accomplish the objectives as limited by the instrumentation in the particular study area. In keeping with this plan, data-collection programs have been skeletonized as follows: Green Creek study area in 1967; Elm Fork Trinity River and Calaveras Creek study areas in 1968; Honey Creek study area in 1969; and Escondido Creek study area in 1970.

During the 1972 fiscal year, basic-data reports, which present a compilation of the annual hydrologic data, were prepared for each study area. A reevaluation of the long-range plan led to discontinuing rain-gage networks in October 1971 in the following skeletonized study areas: Green Creek, Honey Creek, Deep Creek, Escondido Creek, and Calaveras Creek. Data collection in the North Creek study area was expanded to include five floodwater-retarding structures completed during the year.

During the 1973 fiscal year, further reductions in data collection and analysis were initiated in this project. All data collection in the Pin Oak Creek study area was discontinued October 1, 1972. The annual preparation of basic-data reports and storm analyses was discontinued for all skeletonized study areas. An interpretive report on studies in the Honey Creek area will be completed during fiscal year 1975.

Further reductions in data collection in the project were carried out in the 1974 fiscal year so that study areas remaining in the project are only those in the North Creek, Little Elm Creek, and Cow Bayou watersheds. Data collection in these study areas will continue until sufficient "after-development" data have been collected to afford interpretive analyses leading to attainment of the objectives of the project.

Urban-Hydrology Studies

Society is confronted with the most urgent water problems in urban areas, where residential, commercial, and industrial complexes may be subject to potentially destructive floods and where lives and vast sums of money can be saved if metropolitan drainage systems and water-control facilities are properly planned.

Because undeveloped land is being converted to urban use, the amount of impervious surface area is increased, which results in a change in the runoff pattern. Higher peak discharges may result and may be accompanied by more rapid removal of the storm runoff. Drainage systems that were constructed prior to urbanization must be redesigned to function properly under conditions of ultimate land development. Because of these requirements, hydrologic data are needed to define the effects of urbanization on the magnitude of floodflow and runoff from small drainage areas.

The Geological Survey, in cooperation with State and local agencies, is making hydrologic studies in the Austin, Dallas, Dallas County, Houston, Fort Worth, and San Antonio areas. These studies will provide data necessary for defining the changes in storm runoff resulting from progressive urban development and for defining flood boundaries and depths of inundation for floods of various magnitudes and frequencies.

Austin Project

The Austin project, which began in 1954 in cooperation with the Texas Water Development Board, was expanded extensively during the 1975 fiscal year in cooperation with the city of Austin. The objectives of the project are to provide basic rainfall and runoff data and to provide data showing the effects of progressive urbanization on infiltration, rates of peak discharge, rainfall-runoff relations, and quality of streamflow. The project also provides applied research facilities for students at the University of Texas at Austin.

The study initially involved the collection of rainfall and runoff data in the Waller Creek basin, a 4.13-square-mile urban watershed in Austin, and in the Wilbarger Creek basin, a 4.61-square-mile rural watershed 15 miles northeast of Austin. The data collected in the Wilbarger Creek area, which is comparable in size, climate, and geology to the Waller Creek study area, will be used for comparison.

Data are being collected from three recording and three nonrecording rain gages and from the two continuous-record stream-gaging stations in the urban watershed of Waller Creek. Three recording rain gages and one continuous-record stream-gaging station provide data for the Wilbarger Creek watershed.

Data collection during the 1975 fiscal year will be expanded to include additional rainfall data and both quantity and quality of water data in the Bull, Barton, Shoal, Boggy, Walnut, and Williamson Creeks watersheds. Basic-data reports, which contain graphical and tabular data on the rates and volumes of rainfall and runoff from major storms each year, will be prepared annually.

Houston Project

The Houston project, which began in 1964, is in cooperation with the city of Houston and the Texas Water Development Board. The objective of the project is to provide data on the magnitude, frequency, and changes in characteristics of floods that result from progressive urban development.

The data-collection network initially consisted of 7 continuous-record stream-gaging stations, 17 crest-stage partial-record stations (each having recording rain gages), and 5 weighing-type recording rain gages.

The program was expanded during the 1969 fiscal year to include collection of water-quality data on the chemical quality, nutrients, BOD, pesticides, and sediment at five sites. During the 1972 fiscal year, periodic chemical-quality samples were collected at 6 additional sites, and samples for coliform counts and minor-element analyses were collected at 17 sites. The program was also expanded in 1972 to include streamflow quality and quantity data collection before development of a planned "satellite town" in the Panther Branch drainage basin about 25 miles north of Houston.

Program changes in fiscal year 1973 included discontinuing 9 of the 17 crest-stage partial-record stations, installing 8 additional weighing-type recording rain gages, and collecting additional samples for water-quality studies. Data collected in the project through September 1969 afforded analyses that resulted in a report "Effects of urbanization on floods in the Houston, Texas metropolitan area" published in April 1973.

During the 1975 fiscal year, data collection in the project in Houston proper will continue at about the same level as in 1974. However, data collection in the Panther Branch drainage basin will be expanded to obtain more water-quality data requisite to definition of hydrologic effects of the "satellite town" planned for the drainage basin.

Basic-data reports, presenting graphical and tabular data for rates and volumes of rainfall and runoff each year, will continue to be prepared annually.

Dallas Project

The Dallas project, which began in 1961, is in cooperation with the city of Dallas. Data collection is expected to permit analyses aimed at achieving the following objectives: To define the changes in storm runoff resulting from progressive urban development; to define the frequency and magnitude of floods on small urban watersheds; and to define flood boundaries and depths of inundation for floods of various magnitudes and frequencies in and along streams traversing the Dallas metropolitan area.

During the 1973 fiscal year, the following changes were made: Data collection at 87 flood-profile gages, 7 recording rain gages, and 1 flood-hydrograph gage was discontinued; and data collection began at 3 dual-digital flood-hydrograph gages. An interpretive report "Effects of urbanization on floods in the Dallas, Texas metropolitan area", based on data collected in the project through September 1970, was completed during fiscal year 1974.

During the 1974 fiscal year, data collection was expanded in the Fivemile Creek drainage basin by the establishment of three dual-digital type stations and two weighing-type rainfall stations. Rainfall and flood-stage or discharge data will continue to be collected at 6 continuous-record stream-gaging stations, 13 crest-stage partial-record stations, 2 flood-profile stations, and 29 recording rain-gage stations (including 9 gages at partial-record stations). This extensive hydrologic network covers the White Rock Creek, Turtle Creek, Bachman Branch, Joes Creek, Fivemile Creek, Cedar Creek, and Coombs Creek watersheds in Dallas.

Data collection during the 1975 fiscal year will continue at about the same level as in 1974. Basic-data reports, presenting graphical and tabular data for rates and volumes of rainfall and runoff for selected storms during the year, will continue to be prepared annually.

San Antonio Project

The San Antonio project was initiated in 1968 in cooperation with the Texas Water Development Board. The objectives of the project are to collect data on rainfall and runoff in an urban area to define the effects of urbanization on the regimen of streamflow. The data-collection network now consists of three continuous-record streamflow, four flood-profile, six stage-rainfall (dual-digital), and nine recording rainfall stations.

The data-collection program was expanded during the 1969 fiscal year to include samples collected and analyzed periodically from 11 streamflow sites. Results of these analyses will be included in the annual basic-data reports. Analyses scheduled are: Standard chemical; nutrients; BOD; pesticides; and sediment. The program for 1971 was expanded slightly by the addition of a sediment station at Olmos Creek at Dresden Drive. In 1972, the gaging station at Olmos Reservoir was discontinued.

Data collection during the 1975 water year will continue at about the same level as in 1974. Basic-data reports will continue to be published at the end of each water year.

Fort Worth Project

The Fort Worth project was initiated during the 1969 fiscal year in cooperation with the city of Fort Worth. The objectives of the project are to provide data for a logical approach to flood-zoning and flood-protection problems and to analyze the effects of progressive urbanization on runoff. The data will also be useful in the design of storm sewers, culverts, and bridges.

The data-collection network now consists of 5 continuous-record streamflow, 2 stage-rainfall partial-record, 10 weighing-type rainfall, and 43 crest-stage flood-profile stations. These stations are located in the Little Fossil, Dry Branch, and Sycamore Creek watersheds.

During 1970, the data-collection network was expanded by the addition of three continuous-record streamflow stations and four recording rain gages in the Sycamore Creek watershed and a special study area (Seminary South Shopping Center). During the 1971 fiscal year, 16 crest-stage flood-profile stations were added in the Sycamore Creek watershed.

Data collection during the 1975 water year will continue at about the same level as in 1974. Basic-data reports will continue to be published at the end of each water year.

Dallas County Project

The Dallas County urban hydrology study was initiated during the 1969 fiscal year in cooperation with the Dallas County Department of Public Works. The objectives of the project are to provide data necessary for a logical approach to flood-zoning and flood-protection problems and to analyze the effects of progressive urbanization on runoff. These data will also be useful in the design of storm sewers, culverts, and bridges. The study area constitutes all of Dallas County exclusive of the city of Dallas and contains many rapidly urbanizing communities. Those cities in the 20,000 to 100,000 population class include Farmers Branch, Garland, Grand Prairie, Irving, Mesquite, and Richardson. Other communities (less than 15,000 population) include Cedar Hill, Duncanville, DeSoto, Kleberg, Lancaster, Rowlett, Seagoville, and Sunnyvale.

The initial data-collection network consisted of 1 continuous-record streamflow, 2 stage-rainfall (dual-digital), 6 rain-gage, and 21 flood-profile crest-stage stations. These stations were located in the Duck and South Mesquite Creeks watersheds.

During the 1970 fiscal year, the network was expanded by instrumenting Tenmile Creek watershed with one continuous-record streamflow station, eight flood-profile crest-stage gages, and five recording rain gages and by adding a streamflow station and three flood-profile crest-stage stations in the Duck Creek watershed.

Data collecting during the 1975 water year will continue at about the same level as in 1974. Basic-data reports will be prepared at the end of each water year.

Flood Stages and Discharges for Small Streams in Texas (Highway Program)

The highway program, which began in 1965, is in cooperation with the Texas Highway Department and the U.S. Department of Transportation, Federal Highway Administration. The objective of the project is to define the frequency and magnitude of floods on small rural watersheds having drainage areas of less than 20 square miles. This information is needed to establish criteria for properly designing culverts and bridges on highways. Toward this end, 150 crest-stage partial-record stations have been established throughout Texas. Data on flood magnitudes and volumes and on rainfall amounts and intensities are being obtained at each station.

The first report--a compilation of all peak-discharge data collected in Texas through September 30, 1963, for streams draining about 100 square miles or less--was printed in 1966. This report, entitled "Floods on small streams in Texas" was released in January 1966, as a U.S. Geological Survey open-file report. Eight additional reports, containing data for water years 1964-72, have been completed.

During the 1974 fiscal year, a report entitled "Estimating the magnitude of peak discharges for selected flood frequencies on small streams in East Texas" was prepared and distributed as an open-file report. The report contains regression equations affording computation of peak discharges at ungaged sites on small streams.

During the 1975 fiscal year, all data collection under this project will be suspended September 30, 1974. Funds heretofore used for data collection will be used in data analyses aimed at statewide definition of flood characteristics. Completion of analyses and preparation of an appropriate report is anticipated in the 1976 fiscal year.

Chemical and Physical Characteristics of Water in Estuaries of Texas

This study, begun in October 1967, is in cooperation with the Texas Water Development Board. The objectives of the study are to collect data on water temperature, pH, dissolved constituents, concentration of nutrients (phosphorus and nitrogen compounds), minor elements, water velocities and directions, and other data necessary to define the source and distribution of nutrients, current patterns and rates of movement, and the physical and organic water quality in areal distribution and time variation.

Five water-quality surveys of the Sabine-Neches, Brazos, East Matagorda, Colorado, Lavaca-Tres Palacios, Guadalupe, Mission-Aransas, Nueces, and Laguna Madre estuaries, were made during fiscal year 1974.

Special investigations to determine the quantity and quality of fresh-water inflow and the exchange of water between the Sabine-Neches estuary and the Gulf of Mexico will be made during fiscal year 1975.

To supplement available tide-stage records being obtained by the U.S. Army Corps of Engineers and U.S. Geological Survey, 20 tide-stage gages funded by the Corps of Engineers are operated by the Geological Survey. Fifteen additional tide-stage gages are operated as part of the cooperative program with the Texas Water Development Board.

The basic-data will be released to interested agencies on as timely a basis as possible and will be released in an annual basic-data compilation. Interpretive reports will be prepared as the data warrant.

Pesticides Program

The Geological Survey collects, at quarterly intervals, samples for pesticides analyses from a network of stations on streams throughout the western States. Fifteen stations in Texas are included in the network.

Programs in cooperation with the Texas Water Development Board provide for studies of the quantities of chlorinated hydrocarbon pesticides in water and bottom sediments at a network of surface-water stations, in runoff in the Houston, San Antonio, and Austin urban areas, and in selected wells in counties where ground-water studies are in progress.

Continuing Ground-Water Studies

The continuing ground-water studies are detailed studies that are designed to keep abreast of and to evaluate the effects of large withdrawals of ground water in the areas of concentrated pumping. The need for ground-water information in these areas is determined by the particular problems of the area, and the programs of continuing study are carefully planned to meet specific objectives.

Houston Area

The ground-water study in the Houston area, which began on a more or less continuous basis in 1929, is in cooperation with the Texas Water Development Board and the city of Houston. The program proposed for 1975 is a continuation of basic-data collection. Items of work will include an inventory of all new large-capacity wells; periodic measurements of water levels in about 500 observation wells; operation and maintenance of 6 continuous water-level recorders and 5 compaction recorders; collection of water samples annually from about 90 wells for chemical analyses; conducting pumping tests on new large-capacity wells; and an inventory of annual municipal, industrial, and irrigation pumpage. A basic-data report will be prepared during fiscal year 1975.

Galveston County

The ground-water study in Galveston County, which began in 1931, is in cooperation with the Texas Water Development Board and the city of Galveston. The program consists of a compilation and tabulation of records of water-level fluctuations, changes in water quality, pumpage, and land-surface subsidence. For 1975, the program consists of semi-annual measurements of water levels in 90 observation wells, operation and maintenance of 2 continuous water-level recorders and 1 compaction recorder, observation of the chemical quality of water in 35 wells, inventory of all municipal and industrial pumpage, and observance of the effects of land-surface subsidence. A basic-data report will be prepared during fiscal year 1975.

El Paso Area

The ground-water study in the El Paso area began in 1935 in cooperation with the Texas Water Development Board and the city of El Paso. The program for the 1975 fiscal year is in three parts. The first part of the program consists of a continuation of the collection of basic hydrologic data in the Hueco Bolson and Mesilla Valley; measuring about 200 wells annually, 10 semi-annually, 30 quarterly, 4 monthly, and 10 continuously with water-level recorders; inventorying all new wells (excluding shallow irrigation wells); making aquifer tests of large-capacity wells; and collecting water samples from about 14 wells.

The second part of the program consists of compiling and tabulating data for a mathematical model of the lower Mesilla Valley; and the third part consists of defining more accurately the boundary between fresh and brackish water in the city artesian area. A report will be completed in fiscal year 1975 and published as a U.S. Geological Survey Water-Resources Investigations report.

San Antonio Area and Balcones Fault Zone

The ground-water study in the San Antonio area and Balcones Fault Zone, which began in 1949, is in cooperation with the Texas Water Development Board, Edwards Underground Water District, and the San Antonio City Water Board. The objectives of the study are to appraise quantitatively the ground-water resources in the San Antonio area and along the Balcones Fault Zone from Kinney County to the Hays-Travis County line and to continue to investigate the cause and effect relationships in the Edwards aquifer.

The 1975 program consists of continuing to collect and analyze the basic geologic and hydrologic data and to refine the previous evaluations. Items of work include the periodic measurements of water levels in 8 wells; operation and maintenance of continuous water-level recorders on 10 wells; collection of water samples from 5 wells along the bad-water line for chemical analyses of inorganic elements and from 65 wells for some but not all inorganic, biologic, and minor elements and pesticides; collection and compilation of records from 10 rain-gaging stations; inventory of all large-capacity well pumpage and spring discharge; inventory of new wells; and mapping of the principal recharge area of the Edwards aquifer. A basic-data report and two maps will be prepared for release in fiscal year 1975.

Orange County and Adjacent Areas

The ground-water study in the Orange County area, which began in 1967, is in cooperation with the Texas Water Development Board and the Sabine River Authority of Texas. The purpose of this study is to keep abreast of the effects of ground-water development in the area and especially to monitor the fresh-water--salt-water interface as a guide to future development of ground water in Orange and adjacent counties to prevent further salt-water intrusion. The magnitude of industrial and municipal development in the area greatly increases the gravity of the situation.

The 1975 fiscal-year program will consist of the inventory of all new large-capacity wells, including the collection of drillers' logs, electrical logs, and well-construction information; measurements of water levels in about 87 observation wells on a semi-annual basis; operation and maintenance of one continuous water-level recorder; and the location of additional wells suitable for water-level recorders. In addition, water samples from about 58 wells are to be collected annually for chemical analysis; annual municipal and industrial pumpage is to be inventoried; and all data currently and previously collected are to be analyzed, interpreted, and correlated. A basic-data report will be prepared in 1975.

Other Interpretive Studies

Water Resources of Big Bend National Park

This study, which began in July 1966, is in cooperation with the National Park Service. The objective of the study is to determine the available sources of water for Big Bend National Park. The study has been temporarily suspended for 1975.

Artificial-Recharge Research on the High Plains of Texas and New Mexico

This research project, which began during the 1968 fiscal year, is financed wholly by Federal funds. The study will provide information needed in connection with artificial recharge of water obtained from the playa lakes or imported to the High Plains. The study is also providing the opportunity for applied research on methods of artificial recharge. During the 1975 fiscal year, recharge from the surface through spreading ponds will be continued. Additional work is being done on problems associated with recharge through wells, such as the control of sediment in recharge water. Reports on specific aspects of the recharge studies will be prepared when warranted.

Water Resources of Guadalupe Mountains National Park

This study was begun during the 1969 fiscal year in cooperation with the National Park Service. The objectives are to appraise the water resources of this newly established park. Because the present water supply of the area--obtained from wells and springs--is inadequate for anticipated needs, the study will include a complete inventory of wells and springs with particular attention to those areas of immediate need (Frijoles Ranch site, McKittrick Canyon, and the Bowl). The study has been temporarily suspended for 1975.

Hydrologic-Research Studies of the Edwards and Associated Limestones

This ground-water study is in cooperation with the Texas Water Development Board, the Edwards Underground Water District, and the San Antonio City Water Board. All indications, both past and present, indicate that the Edwards aquifer will, in time, become totally developed (in the amount of the natural recharge), and that it will then become necessary to integrate the use of water from the Edwards with water imported from other sources. At that time, it will be necessary to know in as much detail as possible how to get the most water from the Edwards with the least waste, with a minimum conflict between users, and with a minimum detriment to those users who are in less favorable locations.

This study will provide for the complete appraisal of the availability of water in the Edwards aquifer, thereby furnishing valuable and detailed information not now available to all agencies that may be concerned with water management.

The program for 1975 will emphasize the analyses and interpretation of the test-well data in terms of reservoir characteristics. The program will also include: (1) Continued geophysical logging of all available holes; (2) preparation of cross-sections; (3) laboratory analyses of cores; (4) a continuation of the correlation between rainfall and recharge; (5) an evaluation of streamflow records to determine recharge; (6) the collection of water samples for stable and radioactive-isotope analyses, including tritium; (7) collecting about 20 water samples primarily from along or near the bad-water line; and (8) digitization of geophysical logs. Reports on specific aspects of the study will be prepared when warranted.

Digital-Model Study of the Chicot and Evangeline Aquifers of the Texas Gulf Coast

The rapidly increasing demands on the ground-water resources in the Gulf Coast area has made it necessary to evaluate the major aquifers along the Gulf Coast of Texas. The ultimate product of the study will be a digital model, which will serve as a guide for the regional development and protection of the aquifers.

The study will be conducted in several phases, the first of which consists of an evaluation of the ground-water supplies in Colorado, Lavaca, and Wharton Counties. The program for 1975 includes completing the collection of basic geologic and hydrologic data in the three county areas and delineating the aquifers along the Gulf Coast (phase II).

Rio Grande Environmental Study

The present water needs (exclusive of irrigation) of the El Paso area are supplied almost entirely from ground-water sources. The known available supplies of fresh ground water are large, but for future growth, additional sources of water need to be identified. The study will provide information on the amounts and quality of fresh and slightly saline ground water available for development in the Salt Basin, Quitman and Presidio Bolsons, Mesilla Valley, and La Mesa Bolson.

The 1975 program, in cooperation with the Texas Water Development Board, will include completion of the geophysical surveys and preparation of a report which is scheduled for completion in 1976.

Mapping of Flood-Prone Areas

The U.S. Geological Survey is mapping flood-prone areas in Texas by delineating the outline of the 100-year flood on existing topographic maps. This program is part of a Nationwide Federal program designed to aid in reducing flood losses. In addition to the 99 quadrangles completed through June 30, 1973, within the Geological Survey program, a cooperative program was developed with the Department of Housing and Urban Development in which an additional 328 7-1/2-minute quadrangles were completed June 30, 1973. An additional 208 quadrangles will be flood mapped by June 30, 1974, bringing the total of 7-1/2-minute quadrangles mapped in Texas to about 635. In addition, the Geological Survey, in cooperation with the Department of Housing and Urban Development, is making more detailed flood studies to establish actuarial rates in the populated areas within the State. A list of the completed maps is given in the section "Reports in Preparation, Released, or Published During Fiscal Year 1975".

Land-Surface Subsidence in the Texas City and Seabrook Areas

The extensive development of ground water and production of oil and gas in Harris and Galveston Counties has caused large pressure declines in the freshwater aquifers and in the petroleum reservoirs. This decline in pressure has caused compaction of the fine-grained material and has resulted in as much as 9 feet of land-surface subsidence in parts of the area. Lowering of the surface near the bays has subjected much of the area to inundation. High tides cause flooding of the lowlands, and much larger areas are subject to flooding by hurricane tides.

The Corps of Engineers, in its concern for losses caused by hurricane flooding, has developed protection plans that include the construction of levees. The objectives of this study are to predict the amounts and rates of subsidence for use in planning, constructing, and maintaining the levees and holding ponds used for protection. Two reports, one on Texas City and one on Seabrook, will be completed in 1975.

Trinity River Time-of-Travel Study

In 1974, the Trinity River Authority requested an additional study on the West Fork Trinity River (Fort Worth to Dallas). The results of this study will be published in the 1975 fiscal year.

Salt-Water Encroachment, Houston Area

The ultimate objectives of the study, in cooperation with the city of Houston and the Texas Water Development Board, are to determine the location of the fresh-water--salt-water interfaces in the aquifers and to determine the rates of movement of the salt water towards centers of pumping.

The extensive development of ground water in the greater Houston area has caused movement of saline water into the fresh-water sands. Increases of chloride concentrations in fresh ground water have been measured adjacent to interfaces in Galveston and Harris Counties for many years. Salt-water contamination in shallow wells in the vicinity of the Houston Ship Channel has been reported. Recently, water from a well completed in the Chicot aquifer near the channel in the vicinity of Houston has become salty. The Chicot aquifer is the major aquifer in Galveston County and southeastern Harris County. The work in 1975 will include the construction and sampling of three sets of observation wells and the collection of water samples to determine the vertical distribution of the salt water.

Summary Appraisals of the Nation's Ground-Water Resources - Texas-Gulf Region

The purpose of the regional appraisals is to develop and publish as quickly as possible a broad-spectrum analysis of the Nation's ground-water resources. This rapid survey will demonstrate that the Nation's ground water is a large, important, and usable resource, that in many parts of the Nation it can play a significant role in regional water supply, and that it warrants further study and fuller consideration among alternative water sources in regional water resources planning. Coverage of the 21 Water Resources Council regions over a period of approximately 5 years is contemplated, these appraisals to be followed by more detailed subregional investigations concentrating on priority problems disclosed by the regional studies.

The completed series will constitute a national ground-water compendium for the guidance of planning bodies. In much of the country, ground water has received inadequate attention in regional planning, and this series of reports is one means of correcting that deficiency. Further, the completed appraisal series will document the need for expanded programs of investigation of opportunities for ground-water development. It is not expected that new data will be generated by these appraisals, but that data at hand or readily obtainable receive fresh and original analysis, and that the appraisal program serve as a vehicle for imaginative expression of the Survey's views on the water-supply role of the Nation's ground water.

The report on the Texas-Gulf Region was completed in fiscal year 1974 and will be published in fiscal year 1975 as a U.S. Geological Survey Professional Paper.

Miocene Aquifer Study - Gulf Coast Region of Texas

The increasing demands on the ground-water resources of the Texas Gulf Coast requires a more detailed evaluation of the potential of the Miocene aquifers as a source of water supply. The study will result in a digital model, which will serve as a useful tool to aid water planners in the regional development of these aquifers.

The study will be made in four phases, the first of which will begin in 1975 and will consist of delineating the principal aquifer (Jasper and Catahoula) within the Texas Gulf Coastal Region.

Sources of Saline Water in the Upper Colorado River Basin

The segment of the Colorado River between Colorado City and Lake J. B. Thomas has long been known to contain high concentration of salt. Recent investigations suggest that controls on disposal of oil-field brine, diversion of saline water, and other remedial measures are improving the quality of water in the Colorado River. The purposes of this study, in cooperation with the U.S. Army Corps of Engineers, are to delineate the areas of saline inflow and to determine if the quantities of salt reaching the upper Colorado River are decreasing.

Drainage Area Determinations

The objective of this project is to prepare reports containing needed information on the surface drainage of Texas streams. These reports reduce the tendency for different values for the same drainage area to appear in reports of both the public and private engineering sectors.

Reports have been prepared and distributed for the Sabine, Neches, San Jacinto, Trinity, Lavaca, Guadalupe, San Antonio, and Coastal Basins under this project.

The completion of topographic-map coverage in and on the divides of the Brazos River Basin will permit preparation of this report to begin in the 1975 fiscal year.

REPORTS IN PREPARATION, RELEASED, OR PUBLISHED DURING FISCAL YEAR 1975

Basic-Data Reports

Water-Resources Data for Texas

Water resources data for Texas, 1973 - Part I: Surface-water records. Records for the 1973 water year (October 1972 - September 1973) were published as a U.S. Geological Survey report.

Water-resources data for Texas, 1974 - Part I: Surface-water records. Records for the 1974 water year (October 1973 - September 1974) will be published as a U.S. Geological Survey report.

Water resources data for Texas, 1973 - Part II: Water-quality records. Records for the 1973 water year (October 1972 - September 1973) were published as a U.S. Geological Survey report.

Water resources data for Texas, 1974 - Part II: Water-quality records. Records for the 1974 water year (October 1973 - September 1974) will be published as a U.S. Geological Survey report.

Hydrologic Studies of Small Watersheds

Hydrologic data for Cow Bayou, Brazos River basin, Texas, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for Little Elm Creek, Trinity River basin, Texas, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for Mountain Creek, Trinity River basin, Texas, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for Mukewater Creek, Colorado River basin, Texas, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for North Creek, Trinity River basin, Texas, 1973. Limited number of copies to be reproduced by the Texas District.

Urban-Hydrology Studies

Hydrologic data for urban studies in the Austin, Texas, metropolitan area, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for urban studies in the Dallas, Texas, metropolitan area, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for urban studies in the Fort Worth, Texas, metropolitan area, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for urban studies in the Houston, Texas, metropolitan area, 1973. Limited number of copies to be reproduced by the Texas District.

Hydrologic data for urban studies in the San Antonio, Texas, metropolitan area, 1973. Limited number of copies to be reproduced by the Texas District.

Flood Stages and Discharges for Small Streams in Texas (Highway Program)

Flood stages and discharges for small streams in Texas, 1972. This report will be released as a U.S. Geological Survey open-file report (Texas Highway Department and Federal Highway Administration Research Study 4-5-65-85, Interim report 85-9).

Water-Quality Basic-Data Reports

Chemical and bacteriological quality of water at selected sites in the San Antonio area, Texas. This report will be published as a bulletin of the Edwards Underground Water District.

Chemical and physical characteristics of water in estuaries in Texas, October 1970 - September 1971. This report will be published as a Texas Water Development Board report.

Chemical and physical characteristics of water in estuaries of Texas, October 1971 - September 1972. This report will be published as a Texas Water Development Board report.

Water-quality records for selected reservoirs in Texas, 1972-73 water years. This report will be published as a Texas Water Development Board report.

Ground-Water and Other Basic-Data Reports

Ground-water data for Harris County, Texas: Volume I, Drillers' logs of wells. This report was published as Texas Water Development Board Report 178.

Ground-water data for Harris County, Texas: Volume II, Records of wells. This report was published as Texas Water Development Board Report 178.

Ground-water data for Harris County, Texas: Volume III, Chemical analyses of water from wells 1922-71. This report was published as Texas Water Development Board Report 178.

Ground-water data for Brazoria, Fort Bend, and Waller Counties, Texas, 1966-74. This report will be published as a Texas Water Development Board report.

Ground-water data for Chambers, Liberty, and Montgomery Counties, Texas, 1966-74. This report will be published as a Texas Water Development Board report.

Ground-water data for Harris and Galveston Counties, Texas, 1970-74. This report will be published as a Texas Water Development Board report.

Ground-water data for the Orange County area, Texas and Louisiana, 1971-74. This report will be published as a Texas Water Development Board report.

Ground-water discharge from the Edwards and associated limestones, San Antonio area, Texas, 1973. This report was published as Edwards Underground Water District Bulletin 32.

Ground-water discharge from the Edwards and associated limestones, San Antonio area, Texas, 1974. This report will be published as a bulletin of the Edwards Underground Water District.

Records of precipitation, water levels, and ground-water recharge to the Edwards and associated limestones, San Antonio area, Texas, 1972-73. This report was published as Edwards Underground Water District Bulletin 33.

Analytical or Interpretive Reports

County Ground-Water Appraisal Reports

Ground-water resources of Duval County, Texas. This report was published as Texas Water Development Board Report 181.

Ground-water resources of Brazos and Burleson Counties, Texas. This report was published as Texas Water Development Board Report 185.

Ground-water resources of Grimes County, Texas. This report will be published as a Texas Water Development Board report.

Other Analytical or Interpretive Reports

Analog-model studies of ground-water hydrology in the Houston district, Texas. This report will be published as a Texas Water Development Board report.

Digital-model study of ground-water development in the Hueco Bolson near El Paso, Texas. This report will be published as a U.S. Geological Survey Water-Resources Investigations report.

Estimating the magnitude of peak discharges for selected flood frequencies on small streams in east Texas. This report was released as a U.S. Geological Survey open-file report.

Floods of September - October 1967 in south Texas and northeastern Mexico. This report will be published as U.S. Geological Survey Water-Supply Paper 1880-B.

Geological evaluation of the Edwards limestone at core-test sites in the San Antonio area, Texas. This report will be released as a U.S. Geological Survey open-file report.

Hydrologic studies of small watersheds, Honey Creek, Trinity River basin, Texas, 1953-69. This report will be published as a U.S. Geological Survey Water-Resources Investigations report.

Land-surface subsidence at Seabrook, Texas. This report will be published as a U.S. Geological Survey Water-Resources Investigations report.

Land-surface subsidence in the area of Burnet, Scott, and Crystal Bays near Baytown, Texas. This report was published as a U.S. Geological Survey Water-Resources Investigations 21-74.

Land-surface subsidence in the area of Moses Lake near Texas City, Texas. This report will be published as a U.S. Geological Survey Water-Resources Investigations report.

Land-surface subsidence in the Houston-Galveston region, Texas. This report will be published as a Texas Water Development Board report.

The quality of surface waters in Texas. This report was published as U.S. Geological Survey Water-Resources Investigations 7-74.

Reconnaissance of the chemical quality of surface waters of the Rio Grande basin, Texas. This report was published as Texas Water Development Board Report 180.

Relation of precipitation to ground-water recharge in the San Antonio area, Texas. This report will be published as a Texas Water Development Board report.

Simulated water-level changes resulting from proposed changes in ground-water pumping in the Houston, Texas, area. This report will be released as a U.S. Geological Survey open-file report.

Summary appraisals of the Nation's ground-water resources--Texas-Gulf region. This report will be published as a U.S. Geological Survey Professional Paper.

Time of travel of solutes in the Trinity River, Texas, September 1973 and July 1974. This report will be released as a U.S. Geological Survey open-file report.

Bibliographic Reports

Annotated bibliography of water-resources publications and open-file reports for Texas by the Texas Water Development Board and the U.S. Geological Survey through September 1974. This report will be published as a Texas Water Development Board report.

Reports for Texas by the U.S. Geological Survey, Water-Resources Division. This report will be released as a U.S. Geological Survey open-file report.

MAPS OF FLOOD-PRONE AREAS IN TEXAS

These maps show the approximate boundaries of the areas subject to inundation by a 100-year flood, which means that on the average, there is about 1 chance in 100 that the delineated areas will be flooded in any year. The names listed under "quadrangle" indicate the name assigned to the U.S. Geological Survey topographic map series.

Quadrangle	in	County
Albany		Shackelford
Alvarado		Johnson
Atlanta South		Cass
Atlanta North		Cass, Bowie
Baileyboro Northeast		Bailey

Quadrangle	in	County
Bandera		Bandera
Barwise		Floyd, Hale
Benavides		Duval
Ben Bolt Northwest		Duval, Jim Wells
Blanco		Blanco, Kendall
Bloomington		Victoria
Borger		Hutchinson
Bowie		Montague
Breckenridge		Stephens
Brownfield West		Terry
Cactus East		Moore, Sherman
Cactus West		Moore, Sherman
Cameron		Milam
Canton		Van Zandt
Camilla		Polk, San Jacinto
Carrizo Springs Northeast		Dimmit, Zavala
Celeste		Hunt, Fannin
Celina		Collin, Denton
Center Point		Kerr
Childress		Childress
Cisco North		Eastland
Cisco South		Eastland
Clarendon		Donley
Coldspring		San Jacinto
Comanche		Comanche
Comfort		Kendall, Kerr
Copperas Cove		Coryell, Bell, Burnet, Lampasas
Courtney		Grimes, Washington
Cranfills Gap		Bosque, Hamilton
Crockett		Houston
Crosbyton		Crosby
Cuero		De Witt
Cut and Shoot		Montgomery
Cypress		Harris
Daingerfield		Cass, Morris

Quadrangle	in	County
De Kalb		Tex.-Okla., Bowie
De Leon		Comanche
Deport		Red River, Lamar
D'Hanis		Medina
Diboll		Angelina, Polk, Trinity
Dimmitt		Castro
Driftwood		Hays
Driskoll East		Nueces
Dublin		Erath, Comanche
Dumas North		Moore
Dumas South		Moore
Eagle Lake		Wharton, Colorado
East Bernard		Fort Bend, Wharton, Austin
East Brownsville		Cameron
Eastland		Eastland
Edgewood		Van Zandt
El Campo		Wharton
Electra		Wilbarger, Wichita
Falls City		Karnes, Wilson
Florence		Williamson, Burnet
Floydada		Floyd
Floydada Southeast		Crosby, Floyd
Fort Stockton East		Pecos
Fort Stockton West		Pecos
Fostoria		Liberty, Montgomery, San Jacinto
Fredericksburg East		Gillespie
Fredericksburg West		Gillespie
Frisco		Collin, Denton
Fulshear		Fort Bend, Waller
Ganado		Jackson
Garwood		Colorado, Wharton
George West		Live Oak
Giddings		Lee
Gilmer		Upshur

Quadrangle	in	County
Glen Rose East		Bosque, Somervell
Glen Rose West		Bosque, Somervell
Gober		Fannin, Hunt
Gonzales North		Gonzales
Gonzales South		Gonzales
Graham		Young
Grandfalls		Crane, Pecos, Ward
Greenville Southwest		Hunt
Gustine		Comanche, Hamilton, Erath
Hale Center		Hale
Hargill		Hidalgo, Willacy
Harlingen		Cameron
Haskell		Haskell
Hebbronville		Jim Hogg, Duval
Hereford		Deaf Smith
Hilltop Lakes		Leon, Madison
Hodgson		Bowie, Red River
Hondo		Medina
Hunt		Kerr
Jefferson		Marion
Juliff		Brazoria, Fort Bend
Karnes City		Karnes
Katy		Fort Bend, Harris
Kerrville		Kerr
La Feria		Cameron, Hidalgo
Lake Olney		Archer, Young
La Leona		Cameron, Willacy
La Paloma		Cameron
Lefors		Gray
Legion		Kerr
Lelia Lake		Donley
Liberty		Liberty
Lolita		Jackson
Longworth		Fisher
Los Fresnos		Cameron

Quadrangle	in	County
Lorenzo		Lubbock, Crosby
Mabank		Henderson, Kaufman, Van Zandt
Madisonville		Madison
Malakoff		Henderson, Navarro
Malta		Bowie
Manvel		Brazoria
Marble Falls		Burnet, Llano
Marshall West		Harrison
Mason		Mason
Maud		Bowie, Cass
McLean		Wheeler, Collingsworth, Donley, Gray
Menard		Menard
Meridian		Bosque
Monahans		Ward
Moulton		Gonzales, Lavaca
Muleshoe		Bailey
Munday East		Knox, Haskell
Munday West		Knox, Haskell
Myrtle Springs		Van Zandt
Naples		Cass, Morris
Navasota		Brazos, Grimes
Nocona		Montague
Nolanville		Bell
Normangee		Madison, Leon
Oak Grove		Bowie, Red River
Oakwood		Anderson, Leon, Freestone
Olmito		Cameron
Olney		Young
Orchard		Fort Bend
Palmer		Ellis
Pampa		Gray, Robertson
Pasadena		Harris
Pecos East		Reeves, Ward
Pecos West		Reeves
Petersburg		Floyd, Crosby, Lubbock

Quadrangle	in	County
Phillips		Hutchinson
Post East		Garza
Post West		Garza
Poth		Karnes, Wilson
Premont East		Brooks, Jim Wells, Kleberg
Premont West		Jim Wells, Brooks, Duval
Progress		Parmer, Bailey
Purdy Hill		Mason
Pyote East		Ward
Pyote West		Ward
Ralls Northeast		Crosby
Ranger		Eastland
Rankin		Upton
Raymondville		Hidalgo, Willacy
Realitos		Duval
Richmond		Fort Bend
Richmond Northeast		Fort Bend, Harris
Rio Grande City North		Starr
Rio Grande City South		Starr
Rio Hondo		Cameron
Roby		Fisher
Rockdale East		Milam
Rockdale West		Milam
Roma-Los Saenz East		Starr
Roma-Los Saenz West		Starr
Rosharon		Brazoria
Rotan		Fisher
Royse City		Hunt, Rockwall, Collin
Royston		Fisher
Salado		Bell
Sanderson		Terrell
San Diego		Duval
Santa Maria		Cameron, Hidalgo
Santa Rosa		Cameron, Willacy
Seymour East		Baylor
Seymour West		Baylor

Quadrangle	in	County
Somerville		Burleson, Washington
Spearman		Hansford
Springtown		Parker
Stinnett		Hutchinson
Stowell		Chambers
Stockdale		Wilson
Sundown		Hockley, Terry
Sweetwater		Nolan
Tahoka		Lynn
Tilden		McMullen
Tool		Henderson, Kaufman
True		Young
Tule Lake		Swisher
Tuleta		Bee
Tulsita		Karnes, Goliad
Turkey		Briscoe, Hall
Twin Mountains		Coryell, Lampasas
Van		Van Zandt
Van Horn		Culberson
Waelder		Fayette. Gonzales
Wallis		Fort Bend, Austin, Waller
Wasson		Hale
Wellington		Collingsworth
West Brownsville		Cameron
Westcott		San Jacinto, Liberty
Willamar Southwest		Cameron, Willacy
Wills Point		Van Zandt, Kaufman
Wimberley		Comal, Hays
Wink South		Ward, Winkler
Winnsboro		Wood, Hopkins, Franklin
Wolfe City		Hunt
Woodlawn		Harrison, Marion
Yoakum		Lavaca, De Witt
Yorktown East		De Witt, Goliad
Yorktown West		De Witt

SELECTED LIST OF AVAILABLE REPORTS OF GENERAL INTEREST[1/]

U.S. Geological Survey Bulletin 1292: The geologic story of Mount Rainier, by D. R. Crandell. Available from Superintendent of Documents - 85¢

U.S. Geological Survey Bulletin 1307: Synopsis of the mineral resources and geology of Alaska, by Edward H. Cobb. Available from Superintendent of Documents - 70¢

U.S. Geological Survey Bulletin 1327: The geologic story of Canyonlands National Park, by S. W. Lohman. Available from Superintendent of Documents - $2.65

U.S. Geological Survey Bulletin 1348: Placer gold deposits of New Mexico, by M. G. Johnson. Available from Superintendent of Documents - $1.25

U.S. Geological Survey Bulletin 1356: Placer gold deposits of Nevada, by M. G. Johnson. Available from Superintendent of Documents - $2.00

U.S. Geological Survey Bulletin 1357: Placer gold deposits of Utah, by M. G. Johnson. Available from Superintendent of Documents - $1.25

U.S. Geological Survey Bulletin 1361: An integrated system of geologic mapping and geochemical sampling by light aircraft, by C. L. Sainsbury, K. J. Curry, and J. C. Hamilton. Available from Superintendent of Documents - 90¢

U.S. Geological Survey Bulletin 1374: Placer deposits of Alaska, by E. H. Cobb. Available from Superintendent of Documents - $3.10

U.S. Geological Survey Circular 601-H: Role of water in urban planning and management, by W. J. Schneider, D. A. Rickert, and A. M. Spieker. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 601-I: Water facts and figures for planners and managers, by J. H. Feth. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 601-J: Extent and development of urban flood plains, by W. J. Schneider and J. E. Goddard. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 668: Reports and maps of the Geological Survey released only in the open files, 1972, by B. A. Weld, K. T. Iseri, and M. L. Millgate. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 670: Fluvial-sediment discharge to the oceans from the conterminous United States, by W. F. Curtis, J. K. Culbertson, and E. B. Chase. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 671: A land-use classification system for use with remote-sensor data, by J. R. Anderson, E. E. Hardy, and J. T. Roach. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 681: CRIB--The mineral resources data bank of the U.S. Geological Survey, by J. A. Calkins, Olaf Kays, and E. K. Keefer. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 682: Summary of United States mineral resources, by D. A. Brobst, W. P. Pratt, and V. E. McKelvey. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 685: Dissolved-solids discharge to the oceans from the conterminous United States, by D. K. Leifeste. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 686: Large rivers of the United States, by K. T. Iseri and W. B. Langbein. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 690: Seismic hazards and land-use planning, by D. R. Nichols and J. M. Buchanan-Banks. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 693: Remote sensing platforms, by A. V. Colvocoresses. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 694: The worldwide search for petroleum offshore - A status report for the quarter century, 1947-72, by H. L. Berryhill, Jr. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 695: Environmental impact analysis: The example of the proposed Trans-Alaska pipeline, by D. A. Brew. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 698: Mineral resources: Potentials and problems, by W. P. Pratt and D. A. Brobst. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 701: Goals, strategy, and tasks of the earthquake hazard reduction program, by R. E. Wallace. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Circular 703: Water demands for expanding energy development, by G. H. Davis and L. A. Wood. Free on application to the U.S. Geological Survey, Reston, Virginia 22092

U.S. Geological Survey Hydrologic Investigations Atlas HA-511: Flood of June 9-10, 1972, at Rapid City, South Dakota, by O. J. Larimer. Available from Distribution Section, U.S. Geological Survey, Federal Center, Denver, Colorado 80225 - 75¢

U.S. Geological Survey Professional Paper 569-C: Hydrologic significance of lithofacies of the Cane River Formation or equivalents of Arkansas, Louisiana, Mississippi, and Texas by J. N. Payne. Available from Superintendent of Documents - $10.90

U.S. Geological Survey Professional Paper 599-H: Geology of the Sierra Madera cryptoexplosion structure, Pecos County, Texas, by H. G. Wilshire, T. W. Offield, K. A. Howard, and David Cummings. Available from Superintendent of Documents - $2.00

U.S. Geological Survey Professional Paper 697: Landslides of Rio de Janeiro and the Serra das Araras escarpment, Brazil, by F. O. Jones. Available from Superintendent of Documents - $1.50

U.S. Geological Survey Professional Paper 732-B: Scour and fill in Tujunga Wash - a fanhead valley in urban southern California - 1969, by K. M. Scott. Available from Superintendent of Documents - 70¢

U.S. Geological Survey Professional Paper 751-B: Design and operation of the artificial-recharge plant at Bay Park, N.Y., by Ellis Koch, A. A. Giaimo, and D. J. Sulam. Available from Superintendent of Documents - 95¢

U.S. Geological Survey Professional Paper 765: Geology of the oxidized uranium ore deposits of the Tordilla Hill-Deweesville area, Karnes County, Texas: A study of the district before mining, by C. M. Bunker and J. A. Mackallor. Available from Superintendent of Documents - $1.25

U.S. Geological Survey Professional Paper 773: Geologic structures in the Gulf of Mexico basin, by L. E. Garrison and R. G. Martin, Jr. Available from Superintendent of Documents - $2.00

U.S. Geological Survey Professional Paper 787: The Borrego Mountain earthquake of April 9, 1968. Available from Superintendent of Documents - $6.25

U.S. Geological Survey Professional Paper 800-A: Geological Survey Research 1972, Chapter A. Available from Superintendent of Documents - $3.45

U.S. Geological Survey Professional Paper 802-A: Principles and measuring techniques of turbulence characteristics in open-channel flows by R. S. McQuivey. Available from Superintendent of Documents - $1.80

U.S. Geological Survey Professional Paper 809-A: Recognition of natural brine by electrical soundings near the Salt Fork of the Brazos River, Kent and Stonewall Counties, Texas, by A. A. R. Zohdy and D. B. Jackson. Available from Superintendent of Documents - 40¢

U.S. Geological Survey Professional Paper 809-B: Location and characteristics of the interface between brine and fresh water from geophysical logs of boreholes in the upper Brazos River basin, Texas, by W. S. Keys and L. M. MacCary. Available from Superintendent of Documents - 60¢

U.S. Geological Survey Professional Paper 820: United States mineral resources, by D. A. Brobst and W. P. Pratt, editors. Available from Superintendent of Documents - $9.15

U.S. Geological Survey Water Resources Investigations 2-72: Water-temperature data acquisition activities in the United States, by F. H. Pauszek. Available from National Technical Information Service, Springfield, Virginia 22151 - $3.00 (PB2-13972)

U.S. Geological Survey Water Resources Investigations 3-72: Urban hydrology - a selected bibliography with abstracts, by G. L. Knapp and J. P. Glasby. Available from National Technical Information Service, Springfield, Virginia 22151 - $6.75 (PB2-19105)

U.S. Geological Survey Water Resources Investigations 3-73: Effects of urbanization on floods in the Houston, Texas, metropolitan area, by S. L. Johnson and D. M. Sayre. Available from National Technical Information Service, Springfield, Virginia 22151 - $3.00 (PB2-20751)

U.S. Geological Survey Water Resources Investigations 10-73: Artificial-recharge experiments and operations on the southern High Plains of Texas and New Mexico, by R. F. Brown and D. C. Signor. Available from National Technical Information Service, Springfield, Virginia 22151 - $5.25 (PB-222 921)

U.S. Geological Survey Water Resources Investigations 23-73: Index to water-quality data available from the U.S. Geological Survey in machine-readable form to December 31, 1972, Central Region, by C. R. Showen and O. O. Williams. Available from National Technical Information Service, Springfield, Virginia 22151 - $17.00 (PB232 922/AS)

U.S. Geological Survey Water Resources Investigations 27-73: Index to U.S. Geological Survey computer files containing daily values for water parameters to September 30, 1971, Central Region, by C. R. Showen and N. G. Stuthmann. Available from National Technical Information Service, Springfield, Virginia 22151 - $9.00 (PB 232 790/AS)

U.S. Geological Survey Water Resources Investigations 57-73: Index of flood maps prepared by the U.S. Geological Survey through 1973, by P. H. Carrigan, Jr. Available from National Technical Information Service, Springfield, Virginia 22151 - $7.50 (P B233 988/AS)

U.S. Geological Survey Water Resources Investigations 63-73: Digest of the 1972 catalog of information on water data, by F. H. Pauszek. Available from National Technical Information Service, Springfield, Virginia 22151 - $4.00 (PB 323 082/AS)

U.S. Geological Survey Water Resources Investigations 72-001: The SYSLAB system for data analysis of historical water-quality records (basic programs), by T. D. Steele. Available from National Technical Information Service. Springfield, Virginia 22151 - $4.50 (PB-222 777)

U.S. Geological Survey Water Resources Investigations 73-015: Simulation of major inorganic chemical concentrations and loads in streamflow, by T. D. Steele. Available from National Technical Information Service, Springfield, Virginia 22151 - $3.75 (PB-222 556)

U.S. Geological Survey Water Resources Investigations Report: The application of remote sensing techniques to inter and intra urban analysis, by F. E. Horton. Available from National Technical Information Service, Springfield, Virginia 22151 - $3.00 (PB2-14449)

U.S. Geological Survey Water Resources Investigations Report: Remote sensing and photo interpretation, by J. E. Colcord. Available from National Technical Information Service, Springfield, Virginia 22151 - $3.00 (PB2-14864)

U.S. Geological Survey Water-Supply Paper 1970-B: Summary of floods in the United States during 1968, by J. O. Rostvedt and others. Available from Superintendent of Documents - 60¢

U.S. Geological Survey Water-Supply Paper 2028: A national study of the streamflow data-collection program, by M. A. Benson and R. W. Carter. Available from Superintendent of Documents - 45¢

U.S. Geological Survey Water-Supply Paper 2029-C: Use of finite-difference arrays of observation wells to estimate evapotranspiration from ground water in the Arkansas River Valley, Colorado, by E. P. Weeks and M. L. Sorey. Available from Superintendent of Documents - 50¢

1/ For publications available from the Superintendent of Documents, order should be addressed to: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

SUMMARY OF COOPERATION

Organizations assisting in collecting data under cooperative agreements with the Geological Survey are:

Texas Water Development Board. Harry P. Burleigh, Executive Director; John H. McCoy, Chairman; Marvin Shurbet, Vice-Chairman; Robert B. Gilmore, Milton T. Potts, Carl Illig, and W. E. Tinsley, Members.

Texas Highway Department. B. L. DeBerry, State Highway Engineer; Reagan Houston, Chairman; Charles E. Simmons and D. C. Greer, Members.

Pecos River Commission. Horace M. Babcock, Commissioner representing the United States and Chairman; R. B. McGowen, Jr., Commissioner representing Texas; and John B. Walker, Commissioner representing New Mexico.

Sabine River Compact Administration. W. H. Robinson, Commissioner representing the United States and Chairman; R. J. Palmer and H. B. Myers for Louisiana; and J. M. Syler and George Smith for Texas.

County of Dallas. Judson Shook, Director of Public Works.

City of Austin. Charles Graves, Director of Engineering.

City of Dallas. Monroe McCorkle, Director of Public Works.

City of Fort Worth. J. M. Graham, Director of Public Works.

City of Houston. E. B. Cape, Director of Public Works.

Assistance in the form of funds or services is furnished by the following Federal agencies:

Department of Housing and Urban Development.

International Boundary and Water Commission, United States and Mexico, U.S. Section.

Soil Conservation Service, Department of Agriculture.

U.S. Army, Corps of Engineers, Albuquerque District, New Mexico.

U.S. Army, Corps of Engineers, Fort Worth District, Texas.

U.S. Army, Corps of Engineers, Galveston District, Texas.

U.S. Army, Corps of Engineers, Little Rock District, Arkansas.

U.S. Army, Corps of Engineers, New Orleans District, Louisiana

U.S. Army, Corps of Engineers, Tulsa District, Oklahoma.

Assistance in the form of funds or services is rendered by the following organizations through the Texas Water Development Board:

Cities		
Abilene	Clyde	Galveston
Alice	Corpus Christi	Graham
Arlington	Dallas	Houston
Austin	El Paso	San Angelo
Brady	Gainesville	Wichita Falls
Cleburne		

Other Agencies

Athens Municipal Water Authority

Bexar-Medina-Atascosa Counties Water Improvement District No. 1

Bistone Municipal Water Supply District

Brazos River Authority

Chocolate Bayou Land and Water Company

Colorado River Municipal Water District

Dallas County

Dallas Power and Light Company

Dow Chemical Company

Edwards Underground Water District

Franklin County Water District

Greenbelt Municipal and Industrial Water Authority

Guadalupe-Blanco River Authority

Harris County Flood Control District

Houston Lighting and Power Company

Lone Star Steel Company

Lower Colorado River Authority

Lower Neches Valley Authority

Mitchell Development Corporation of the Southwest

North Central Texas Municipal Water Authority

Northeast Texas Municipal Water District

Palo Pinto County Municipal Water District No. 1

Red Bluff Water Power Control District

Reeves County Water Improvement District No. 1

Richmond Rice Association

Sabine River Authority of Texas

San Antonio City Public Service Board

San Antonio City Water Board

San Antonio River Authority

San Jacinto River Authority

Tarrant County Water Control and Improvement District No. 1

Texas Electric Service Company

Texas Utilities Services Inc.

Tom Green County Water Control and Improvement District No. 1

Trinity River Authority

Upper Guadalupe River Authority

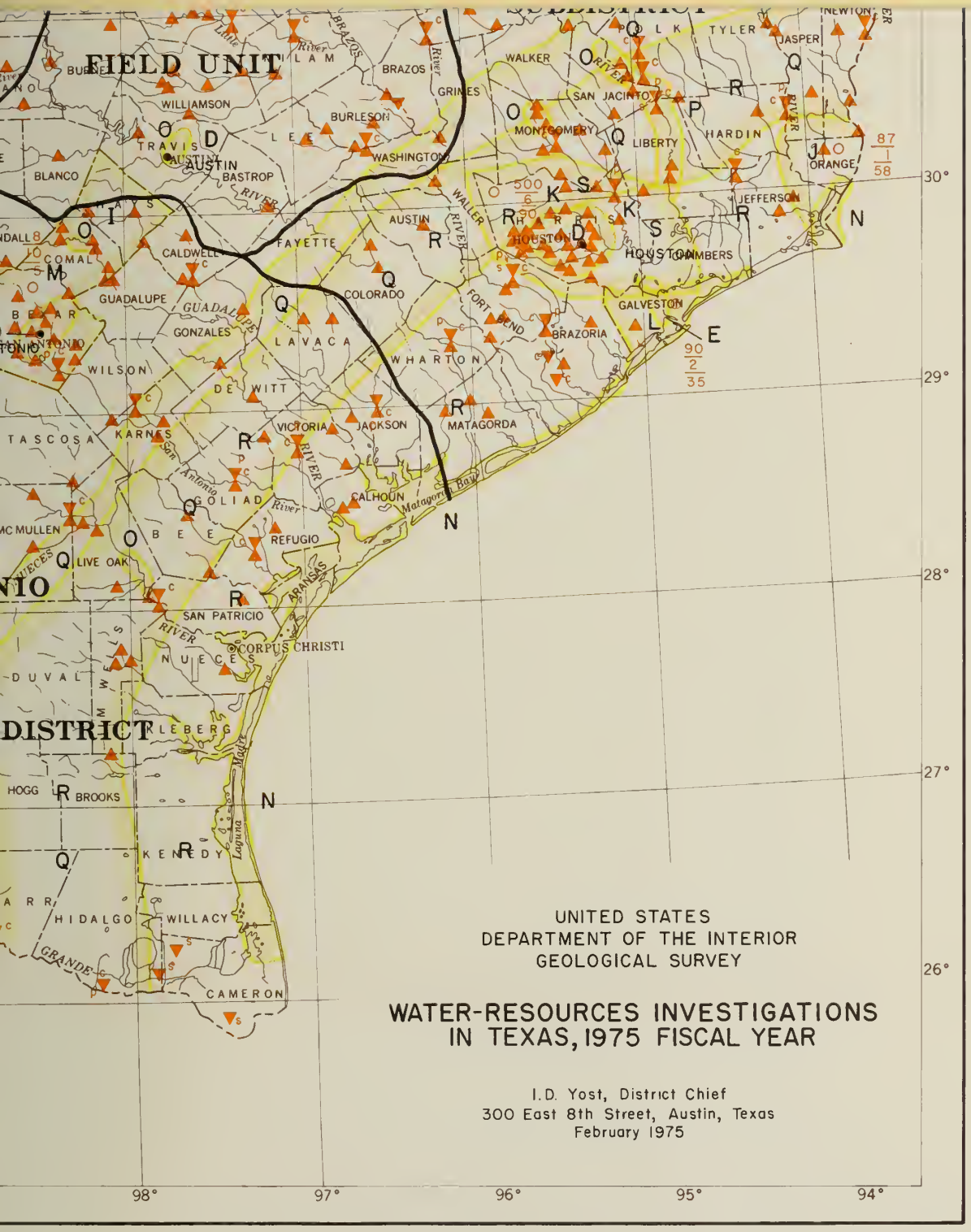
Upper Neches River Municipal Water Authority

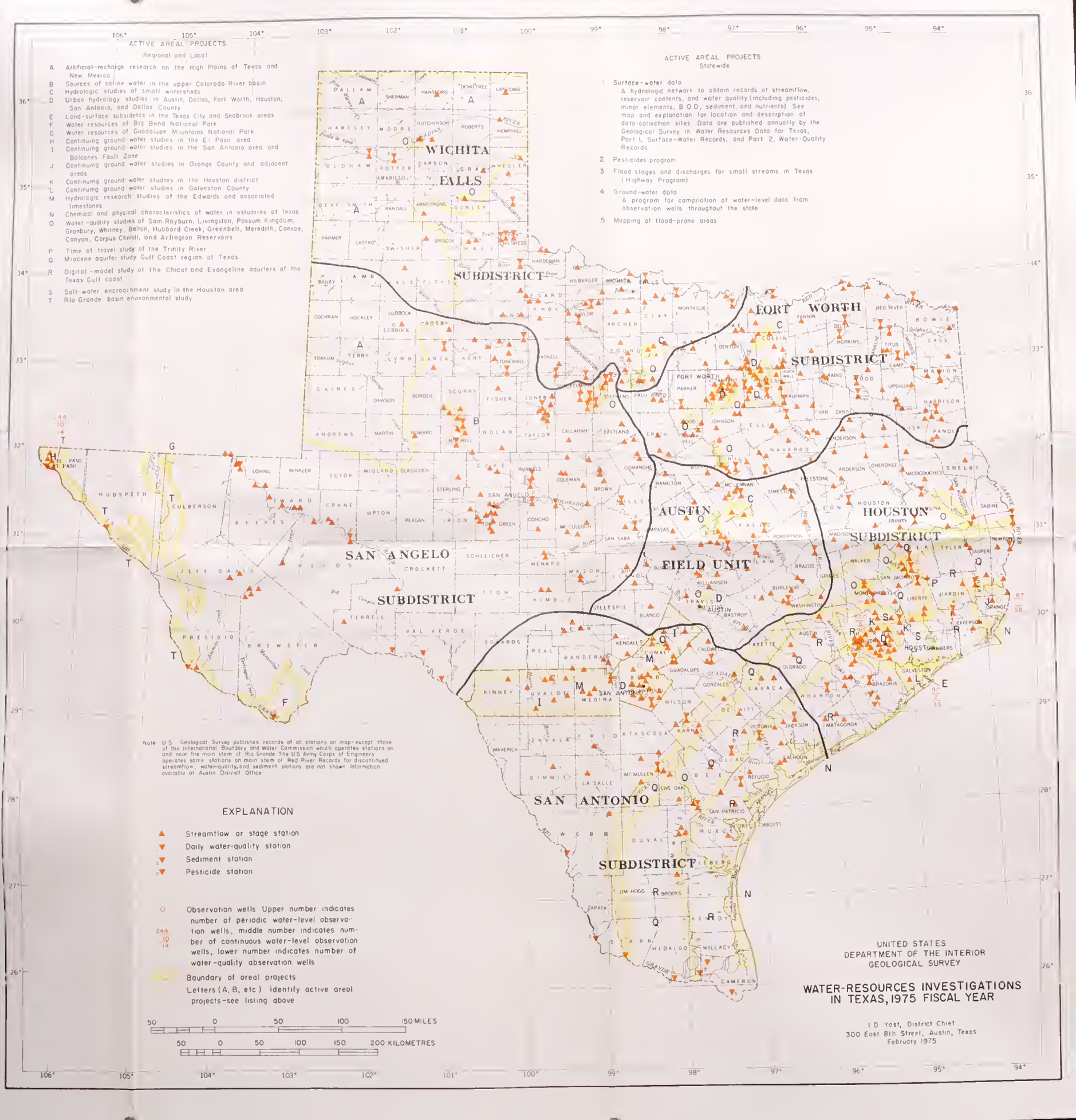
West Central Texas Municipal Water District

White River Municipal Water District

Wichita County Water Improvement District No. 2

Wood County


FIELD UNIT
DISTRICT
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER-RESOURCES INVESTIGATIONS
IN TEXAS, 1975 FISCAL YEAR
I.D. Yost, District Chief
300 East 8th Street, Austin, Texas
February 1975
AUSTIN
HOUSTON
SAN ANTONIO
CORPUS CHRISTI
GALVESTON
30°
29°
28°
27°
26°
98°
97°
96°
95°
94°


ACTIVE AREAL PROJECTS
Regional and Local
A Artificial-recharge research on the High Plains of Texas and New Mexico
B Sources of saline water in the upper Colorado River basin
C Hydrologic studies of small watersheds
D Urban hydrology studies in Austin, Dallas, Fort Worth, Houston, San Antonio, and Dallas County
E Land-surface subsidence in the Texas City and Seabrook areas
F Water resources of Big Bend National Park
G Water resources of Guadalupe Mountains National Park
H Continuing ground-water studies in the El Paso area
I Continuing ground-water studies in the San Antonio area and Balcones Fault Zone
J Continuing ground water studies in Orange County and adjacent areas
K Continuing ground-water studies in the Houston district
L Continuing ground-water studies in Galveston County
M Hydrologic research studies of the Edwards and associated limestones
N Chemical and physical characteristics of water in estuaries of Texas
O Water-quality studies of Sam Rayburn, Livingston, Possum Kingdom, Granbury, Whitney, Belton, Hubbard Creek, Greenbelt, Meredith, Conroe, Canyon, Corpus Christi, and Arlington Reservoirs
P Time of travel study of the Trinity River
Q Miocene aquifer study Gulf Coast region of Texas
R Digital-model study of the Chicot and Evangeline aquifers of the Texas Gulf coast
S Salt-water encroachment study in the Houston area
T Rio Grande basin environmental study
ACTIVE AREAL PROJECTS
Statewide
1 Surface-water data
A hydrologic network to obtain records of streamflow, reservoir contents, and water quality (including pesticides, minor elements, B O D, sediment, and nutrients) See map and explanation for location and description of data-collection sites Data are published annually by the Geological Survey in Water Resources Data for Texas, Part 1, Surface-Water Records, and Part 2, Water-Quality Records
2 Pesticides program
3 Flood stages and discharges for small streams in Texas (Highway Program)
4 Ground-water data
A program for compilation of water-level data from observation wells throughout the state
5 Mapping of flood-prone areas
WICHITA FALLS SUBDISTRICT
FORT WORTH SUBDISTRICT
AUSTIN FIELD UNIT
HOUSTON SUBDISTRICT
SAN ANGELO SUBDISTRICT
SAN ANTONIO SUBDISTRICT
Note U S Geological Survey publishes records of all stations on map-except those of the International Boundary and Water Commission which operates stations on and near the main stem of Rio Grande The U S Army Corps of Engineers operates some stations on main stem of Red River Records for discontinued streamflow, water-quality, and sediment stations are not shown Information available at Austin District Office
EXPLANATION
Streamflow or stage station
Daily water-quality station
Sediment station
Pesticide station
Observation wells Upper number indicates number of periodic water-level observation wells, middle number indicates number of continuous water-level observation wells, lower number indicates number of water-quality observation wells
Boundary of areal projects
Letters (A, B, etc) identify active areal projects-see listing above
50 0 50 100 150 MILES
50 0 50 100 150 200 KILOMETRES
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER-RESOURCES INVESTIGATIONS IN TEXAS, 1975 FISCAL YEAR
I D Yost, District Chief
300 East 8th Street, Austin, Texas
February 1975

UNIVERSITY OF ILLINOIS-URBANA
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